

A Public-Private Partnership Procurement Approach to Sustainable Transport—Zimbabwe Case

Vinnet Ndlovu, Peter Newman

Curtin University Sustainability Policy Institute (CUSP), Curtin University, Perth, Australia
Email: vinnet.ndlovu@gmail.com

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Abstract

Zimbabwe has serious financial constraints so the only viable option to procure infrastructure is through engaging the private sector in public-private partnerships to enhance the chances of successfully undertaking public projects like sustainable transport. This study creates the basis for a potential public-private partnership with a trackless tram/solar energy project in Bulawayo which has multiple advantages for sustainable development goals. It identifies six other projects in Zimbabwe that can provide some guidance for developing an appropriate PPP that could assist procure such infrastructure. The projects are drawn from the three critical sectors of the economy: power generation, highways/transport, and water/sanitation. Empirical investigations of these projects reveal the effectiveness of the PPP concept to deliver infrastructure for emerging economies. This suggests an ideal PPP arrangement that increases the likelihood of getting projects like the proposed sustainable transport project in Bulawayo implemented quickly and efficiently, especially if formulated to incorporate the project's local socio-economic dynamics.

Keywords

Public-Private Partnership, Public Infrastructure, Trackless Trams, Sustainable Development Goals

1. Introduction

Most low to middle income countries in Africa are finding it increasingly difficult to fund the construction and maintenance of critical public infrastructure for the development of their economies, even though these countries are much endowed with high value natural resources that have potential to catapult them

into high-income economies. What is needed is the ability to develop infrastructure that will facilitate and drive the necessary economic development and growth [1]. The prevalent vicious cycle of poverty is partly because of the lack of capital to develop these public projects that are necessary to unlock economic potential. New approaches need to be explored so that the governments of these countries can fund such infrastructure-based developments, especially in their major cities, and contribute to global and local sustainable development [2].

Transport and energy are two fundamental infrastructure systems in any city. There are new technological opportunities that can enable cities in the developing world to leapfrog into a better future by combining these: a new electric transit technology labelled trackless tram systems (TTS) and the new low-cost roof-top solar power or photovoltaics (PV) that can be integrated into the TTS [3]. This paper will show how a public-private partnership (PPP) procurement system can be developed to enable such a TTS-PV infrastructure Model studied by Ndlovu and Newman [4] to be built in a city like Bulawayo in Zimbabwe. The idea has already received considerable interest in the city based on this research [5] and private sector interest in providing investment as part of a Transit Mall has been generated locally.

Newman, Davies-Slate [6] discussed four approaches to funding urban rail systems that have emerged since “the second rail revolution” has created much more interest from private finance in rail projects. Approaches discussed are the fully private funded, fully public funded and the two in between, with each having a bias towards either a private or a public funded majority. The research indicated that the more private funding was injected into the project the more urban development was integrated into the transport project as they are able to make use of land value increases. This integration is difficult when governments alone run transport projects. Adding a solar energy component into a transport project may make this even more useful and interesting for private investors to become involved in a land development-based financing of an infrastructure project. The paper therefore will work towards a procurement partnership model that can bring as much private money as possible into the preferred PPP approach whilst enabling common good outcomes required by governments. Such a model will be suggested as a way for any emerging city to pursue economic development with significant opportunities to simultaneously meet climate and United Nations’ Sustainable Development Goals (SDG) outcomes.

1.1. Public Private Partnership (PPP) Concept and Types

A Public Private Partnership is where the public sector partners with the private sector to build, develop and maintain public services while sharing the risks, benefits and costs that accrue from it. Koppenjan [7] refers to PPP as a procurement approach where the project is undertaken with a broader span of contractual obligations between the public and private sector to provide an asset and/or a service. The two definitions align with the World Bank [8] description

which suggests a PPP is a procurement model to deliver public infrastructure or service that cuts across various sectors such as transportation, water treatment, energy, environment, education, health, and amenities such as the old age facilities studied by Zheng, Lu [9]. Also elaborated by Yuan, Chan [10], Buljevich and Park [11], and Yescombe [12], there are a range of different types of PPP's and these are briefly summarised before proceeding to see which ones are best for African infrastructure and for the TTS-PV.

The most common types of PPPs are service contracts, affermage or lease contracts, Build-Operate-Transfer (BOT) and similar arrangements and joint ventures. These are discussed in greater detail below.

1.1.1. Service Contract

This is a special type of PPP where a private partner is hired by the government to perform specified tasks or service as per the contract agreement for a period typically less than 3 years. The primary responsibility to provide the public service or infrastructure remains with the government while a portion of that responsibility is contracted to the private sector partner. Quality standards to be adhered to are documented while the cost of the service to be provided is stated in monthly or yearly terms. The contract is honoured by the government through payment of an agreed service fee which is determined by the unit cost or arrived at using some other criterion. The private sector will therefore aim to efficiently manage operational costs and adhere to stipulated quality standards so as to realise incremental profits. This type of PPP is preferred by governments because it brings private sector expertise and efficiency in upholding service quality, a feature which can be missing in governments and increasingly governments are moving away from operational roles to more strategic and regulatory roles. However, service contracts are unsuitable for attracting new capital for large infrastructure projects [13].

1.1.2. Affermage/Lease Agreements

In this arrangement, the private sector is responsible for the entire service provision while meeting the agreed service standards and quality on behalf of the government. The government will however be responsible for any new investment or replacements on the public service or facility. Typically, service agreements last for 10 years with a possibility for renewal up to 20 years by both parties. Once the role of providing the public service passes from the government to the private partner, the latter will be liable for any losses and unpaid debts by the consumer. The lease agreement does not involve transfer of ownership or sale of assets. Like service contracts, lease agreements ensure that higher levels of efficiency and quality are achieved by the private sector partner in the process of chasing after higher revenues and profits [13]. In Asia, lease agreements are mainly utilised in the operation of airport terminals and seaport container terminals. Thailand and India have current lease agreements for the handling of containers at their seaports in Bangkok and Cochin. The contract for India was initially for

8 years while the Thai contract ran for 7 years involving local companies. In China, the Keppel Group from Singapore operates the Guangzhou Baiyun Airport Terminal under a 15-year lease agreement [14]. Again, these lease arrangements do not bring in private investment.

1.1.3. Built-Operate-Transfer (BOT) and Similar Arrangements

The BOT and similar arrangements are widely used models of PPPs because of their clarity and ability to attract new capital. The private partner or consortium formed for that purpose develops and finances new infrastructure projects or a major component of the project as per set performance standards by the public partner. Under BOT, the private partner owns the public asset for a period specified in the contract so as to recover investment costs through charging users usage fees. BOTs often require large financing schemes and longer repayment periods especially under situations where demand for the service or infrastructure is seasonal. **Table 1** shows the various delivery options under BOT arrangements. BOTs have largely been adopted for many PPPs especially in public infrastructure construction and renovations as they have massive opportunities to attract private sector capital. Since the government is often the sole customer, BOTs tend to limit the level of commercial risk to the private partner.

However, the BOT model is modelled on the need for certainty on the part of contract partners in terms of honouring the contract in order to bring stability to the utilisation of the public service. In India, the Build-Own-Operate and Transfer (BOOT) was used to construct the Gujarat Toll Road. The contract for the 32 km road facility included the construction of pavements, cross-drainage works, toll facilities, separators, bridges and medians. The contract also encompassed maintaining and managing the Gujarat Toll Road in terms of traffic regulation, toll collection and operation of the plaza. A fixed formula is used in calculating and determining toll rates by the contractor who enjoys relative autonomy from the government. A toll committee which advises the government is constituted from time to time to review toll fees in the face of inflation [14].

Table 1. Basic BOT delivery options.

Arrangement	Owner	Conceive	Design	Build	Operation & Maintenance	Financial Responsibility
Design-Bid-Build (DBB)		Public		Private by fee contract	Public	Public
Design-Build (DB)		Public				Public
Build-Operate-Transfer (BOT)	Public	Public				
Design-Build-Finance-Operate (DBFO)		Public or Private			Private by fee contract	Public, Public, Public/Private, or Private
Build-Own-Operate (BOO)					Private by contract (Concession)	

Source: US department of transportation [15].

1.1.4. Joint Venture

A joint venture involves co-ownership of the public service or infrastructure by the private partner and the government. It can be viewed as partial privatisation since the public service will be managed via a Special Purpose Vehicle (SPV) or joint ownership of an established company through the sale of shares to the private investor(s). Sound corporate governance is however key in managing the delivery of a public service especially in maintaining independence from government and political interference. In most cases the government wields immense power as the co-owner, lawmaker, regulator and consumer; as such the temptation to interfere and dictate terms in the management of the JV is huge [13]. In 2009, The Chisumbanje Ethanol Project was commenced in Zimbabwe under the Green Fuel company name. Green Fuel is a joint venture of the Zimbabwe government's Agricultural and Rural Development Authority (ARDA) along with Macdom and Ratings Investments owned by a private partner. The \$600 million project is the biggest of its kind in Africa and produces approximately 100 million litres of Ethanol, enough to supplement 50% of Zimbabwe's petroleum needs. The project produces approximately 18 Megawatts (MW) of power as a by-product and supplies it to the national grid. The output is enough to power 30, 000 households while import substituting foreign currency [16].

Joint Ventures and BOT arrangements will be the focus of further analysis as they are able to provide private investment.

1.2. Public-Private Partnership and Transport Projects

In 1992, the United Kingdom government introduced the Private Finance Initiative (PFI) aimed at encouraging PPP initiatives and as a result there was a lot of private sector interest in public infrastructure development especially transport. Since then, most South American cities especially in Brazil and Chile have also effectively embraced the PPP models to partially or fully fund some of their major transport infrastructure projects. To date, PPPs are responsible for financing and managing about 24% of public services in the UK [17]. Notable examples of countries that have done well with the adoption of the PPP concept to build their public infrastructure include China, India, Brazil, Chile, Malaysia and Poland. According to Willoughby [18], PPP projects in transport for developing countries totalled approximately USD30 billion in 2006. The benefits that make PPPs largely successful were elaborated by Meidutė and Paliulis [19] and Willoughby [18] as follows:

- Financing advantage to resource constrained developing countries;
- Efficiency advantage brought about by the private partners to their public counterparts;
- Innovation advantage that are commonly associated with private sector;
- Growing need for infrastructure as most urban growth is outpacing the capacity of the public sector to provide the necessary infrastructure development;
- Quality improvement and reduction in public services costs.

Public transport has been very slow at developing PPP approaches [20] but most OECD countries are now utilising PPP's for the development, construction and operation of light rail transit (LRT) projects. There is generally a sense that PPP's are working, however the main concern is that the gestation of these PPP projects is typically 4 - 6 years [18]; thus there is a need to reduce these times and their transaction costs with Spain showing the way with an average gestation period of 8 months.

According to Newman, Davies-Slate [6] there should be a linkage between investment in transit infrastructure projects and land development to share in the increased land value created. The best examples of this are in Japan and Hong Kong where it is estimated that on average the Hong Kong MTR generates 50% of its net earnings from its associated real estate business transactions that are built along its train stations and along its rail infrastructure. In China, the Beijing Mass Transit Railway (BMTR) Corporation and its sister company Beijing Capital Group (a local property developer) is another PPP success which has promoted the transit-oriented development (TOD) approach similar to the Hong Kong Mass Transit Railway (MTR) business model. The transfer of gains from property development into transport infrastructure budgets has now led to a new form of TOD-inspired PPP.

In order to create a TOD-based PPP it is necessary to structure a contractual partnership that correctly understands the expectations of each partner. It is expected that the private sector is driven by the profit maximisation philosophy, whereas the public sector is driven by the notion of increasing public service availability and satisfaction. Finding an ideal balance between the desired expectations of the two partners at the onset of a PPP drafting is crucial for the partnership's success. Liang, Wu [21] developed a two-sided matching model to determine the optimal partnership between the public and private sectors. This model could be utilised to identify the crucial allocation of risks and benefits to the partners. The West European experience does show the efficiency of PPPs is maintained when there is harmony between partners [19].

Such novel procurement and funding schemes inevitably face a lot of resistance from local and traditional groups. Johannesburg in South Africa suffered from this type of resistance when it proposed to introduce its first Bus Rapid Transit (BRT) project. Santiago in Chile faced similar challenges for over a decade in the 1990s [18]. However, Sao Paulo in Brazil had great success compared to most cities. It had breadth of involvement of most private parties across the transport sector than in Johannesburg and Santiago. According to Willoughby [18], Sao Paulo city is now optimistic and confident about a PPP procurement concept to deliver infrastructure to the extent that it projects that from 2006 to 2025 the investment in its road infrastructure will be approximately US\$23 billion, with a third of that investment coming from PPP arrangements. As well as Brazil's successes, among the low to middle-income countries and OECD countries, Chile scores highly on the infrascopes index [22]. Regardless of the resistance Santiago went through, it finally managed to reduce the aggressive compe-

tition on road for the traditional buses by reducing the numbers from 7700 to 5800 and introducing the BRT through a PPP concept [18].

Lack of a conducive legal framework and regulatory governance seems to have contributed to the uptake failures of some PPP projects, and in some cases weakened their performance. The factors that need to be considered to enhance urban transit projects are:

- Robust civic consultation systems;
- Integrated land-use/transport planning system;
- Land/property market management;
- Monitoring systems;
- Progressive policies,
- Economic regulation;
- Public institutional framework for urban transport PPP [18].

Meidutė and Paliulis [19] show that such PPPs are likely to lead to faster development and implementation of projects as long as all the terms and conditions which underpin the legal framework, risk evaluation and allocations, liabilities and dispute resolutions are explicit. The managerial expertise of the private sector is also likely to promote quick project implementation. They also suggest that the barriers to proper implementation of PPP projects are:

- The absence of clear and expedient political will;
- Poor legal framework for PPPs;
- The absence of public authority to manage PPP initiatives;
- No public campaign to champion the PPP initiatives.

These shortcomings will need to be addressed if PPP projects are to be implemented successfully. Nigeria as an emerging economy has recognized the importance and positive impact PPPs have in enhancing its ability to develop its public infrastructure. According to Kadiri, Ojo [23] this has led to Nigeria enacting the Infrastructure Concession Regulatory Commission (ICRC) Act of 2005 which provides a legal framework for the adoption of PPPs for infrastructure development.

According to Zin Zawawi, Kulatunga [24] unsolicited PPP proposals have been acknowledged and are recognised in major international procurement frameworks including World Bank, Asian Development Bank, African Development Bank (AfDB) and European Bank for Reconstruction and Development. The most notable countries that have developed channels to receive unsolicited PPP proposals are: South Africa, Australia, China, Philippines, India, Indonesia, USA and Malaysia. Malaysia's Guideline on Public Private Partnership was published in 2009 and according to Zin Zawawi, Kulatunga [24] unsolicited proposals have proven to be a stimulant and catalyst for developing and procuring infrastructure and public services in Malaysia. South Africa is probably the leader on PPP's in Africa with the Economic Development in Africa Report [25] showing that South Africa has the greatest cumulative experience of public-private partnerships in Africa, with over 50 such partnerships at the development or

implementation stage from national to provincial level, some of these are in transit.

1.3. The PPP Potential for Zimbabwe

Zimbabwe is a country with great potential, endowed with natural resources such as minerals. It can harness its natural resources through focusing on strategic national projects such as the ones to be identified in this study. However, as already noted the country has been going through economic decline for the past two decades, and is heavily in debt, and financially constrained [26]. Critical sectors of the economy that are vital for the resuscitation of the country's economy have been hit hardest during these past two decades of the economic decline, and hence the requirement of significant amounts of capital investment. The country has many potential projects that are under feasibility studies or have been parked because of lack of funds by the government.

The Zimbabwe Government has been reticent to negotiate PPP's but there is evidence from neighbouring country projects that governments can always negotiate a PPP model that reflects a win-win scenario acceptable to both parties. Such projects have been successfully implemented in the past in South Africa. The Limpopo Toll Bridge at the Beitbridge Border Post was built under a 20-year Build-Operate and Transfer (BOT) arrangement in 1994. The Beitbridge-Bulawayo Railway (BBR) line was implemented on a BOT model by Beitbridge Bulawayo Railway (Private) limited in July 1999. Similarly, the 820 km Plumtree-Bulawayo-Mutare Highway rehabilitation was constructed by Group Five of South Africa with funding from Development Bank of South Africa (DBSA) in 2014. All these are examples of remarkable modern-day Zimbabwe projects which were implemented under PPPs and are benefiting the economy.

This study selected a few major projects which are under consideration and if developed would have a potential to positively impact the economy of the country. For example, the potential power projects within the Zambezi basin have the potential to generate more than 600,000 direct and indirect jobs. Provision of affordable and reliable electricity is a key in alleviating poverty and re-industrializing the economy. The two water and sanitation projects discussed in the next section have massive potential to turn the perennial arid and drought prone provinces of the country such as Matebeleland North, South and Bulawayo into green zones that will be able to foster agricultural production throughout the whole year. Jobs and income generation created in these new green belts will help reduce poverty levels while increasing demand for other goods and services for the local and national economy. The rehabilitated highway networks will promote trade and tourism in the Southern African region and increase the country's tourism visibility to international visitors. The trackless tram project outlined below will act as a catalyst to enable the city of Bulawayo to reconstruct/resurface its dilapidated roads, leapfrog into a new mid-tier transit technology, bring in solar-based urban regeneration and act as a stimulant for the economic revival of the city of Bulawayo [3] [4] [27]. Together these projects have the potential

cumulative effect of creating more than 2 million jobs in Zimbabwe. It is therefore important to create a PPP legal framework so that these projects can be delivered.

1.3.1. Transport/Highway Projects

Zimbabwe has 88,318 km of road network (21% being tarred) which is maintained by local authorities and the central government via disbursements from Zimbabwe National Roads Administration (ZINARA). Beitbridge-Harare-Chirundu Highway Project (971 km) and the Beitbridge-Bulawayo-Victoria Falls Highway Project (645 km) are the busiest highways in Zimbabwe connecting the southern parts of the country to the northern parts and facilitating trade and movement of labour in the Southern African Development Community (SADC) region. The routes are vital to Zimbabwe's economic fortunes as Beitbridge sits on the border with South Africa and the highway carries most of the goods transported between these and other adjacent countries. Decades of neglect have left the two busy highways in a poor state and it has been worsened by the haulage trucks which ply the routes. The construction of the highways is expected to improve the quality of the national road network, which has outlived its lifespan of 20 years by almost 35 years. The highways will provide passage from South Africa to countries such as Zambia, Malawi, Tanzania and DRC to the north via the north to south trade corridor. Rehabilitating the two highways is expected to help boost Zimbabwe's economy while also curbing fatal accidents on the narrow roads that connect Beitbridge to Harare and Bulawayo.

1) The Beitbridge-Bulawayo-Victoria Falls Highway

The Beitbridge-Bulawayo-Victoria Falls highway is also significant for tourism to Matopos, Khami Ruins, Victoria Falls, Binga and Hwange National Parks. Accessibility to tourism hotspots boosts Zimbabwe's status as a tourism hub while providing foreign currency earnings for tourism companies. Tourists will also be a big part of the toll fees that can ensure the PPP has an effective IRR.

2) The Beitbridge-Harare-Chirundu Highway

The Beitbridge-Harare-Chirundu Highway accounts for more than 60% of the national traffic in Zimbabwe, thus the payback period for the project via payments of toll fees will be shorter than the other highway project. The highway is pivotal in the provision of consistent revenue streams for the national roads manager (ZINARA) and maintenance of other country roads by the District Development Fund (DDF), Rural and Urban Councils that receive periodic allocations from the collected vehicle licensing and toll fees. The highway is the lifeblood for business activities in transit towns such as Ngundu, Rutenga, Masvingo, Chivhu and Chinhoyi.

The construction of the two highways will provide direct employment to a number of civil engineering contractors and thousands of jobs for various value chain players in the economy. The projects will encompass widening of the highways to SADC standards, resurfacing and dualisation when approaching major towns and cities. In 2017, ZINARA collected \$212 million from Toll Fees

and Vehicle licenses, suggesting that the country has capacity to be able to repay the rehabilitation of the two strategic highways from toll fees while enabling economic growth.

PPPs under the Build Operate and Transfer (BOT) model are ideal for these two highway projects as they can be financed by the road users via Toll and Transit Fees over time.

1.3.2. Power Projects

1) Batoka Gorge Hydroelectric Scheme (BGHES):

According to the World Bank [28] the BGHES project is estimated to cost US\$2.6 billion to construct and will have an installed capacity of 2400 megawatts which will generate annual revenues of US\$663 million. If the operating and maintenance costs of 8% are deducted the expected net revenues are US\$608 million. A general simple calculation of the payback period shows a pay-off period of less than 5 years. However, Ansar, Flyvbjerg [29] showed that in most cases budgets for such large-scale projects do go above the original estimates. Should the project construction costs for the BGHES double its original budget from US\$2.6 billion up to \$5.2 billion, the project's internal rate of return will still remain positive at 15.4% and 5.2% for Zambia and Zimbabwe respectively, and the payback period will still be attractive for private investors but is approaching the point where it would not receive private investment.

Zimbabwe and Zambia are currently reeling under heavy power deficits which often lead the two countries to resort to power shedding and importing emergency power at exorbitant rates. It is envisaged that the BGHES construction is likely to take 7 years to complete with a PPP arrangement that involves the two governments of Zimbabwe and Zambia. However, should the project be more inclined to a 100% private PP structure, construction could be shortened to within the planned 5 years.

Another factor with a hydropower PPP is that it is generally a predictable project where the outcomes are likely to be welcomed over the long term, especially in a world that is decarbonizing. According to the World Bank report, "Hydropower investments are characterized by stable, long-term revenue streams coupled with low operation and maintenance costs. These provide the basis for attracting repayable finance, which can include loans, bonds, and equity" [28]. Hence the reason why the BGHES should have a high visibility of attraction to potential private investors such as Superannuation Funds, to quicken its implementation. According to the World Bank [28] the BGHES has a financial internal rate of return (FIRR) of 16.1 percent and 17.2 percent for Zimbabwe and Zambia respectively; and its economic internal rate of return (EIRR) is 20.6% and 26.7% for Zimbabwe and Zambia respectively. These are the rate of returns required by the private sector to invest in emerging economies as elaborated by Blanc-Brude, Whittaker [30], and they (private investors) are likely to be looking for PPP's that can structure such opportunities. Institutional investors such as Superannuation Funds are the typical major private investors that have a large

capital base looking for investments through large projects with an expected long-term revenue stream that usually run more than 20 years. These funds are also looking for Net Zero projects that can meet the objectives of groups like climate 100+ with their increasing global commitment to Paris agreement-consistent projects.

2) Solar Projects:

Solar energy projects are quicker and easier to deliver than large-scale hydro projects. The Gwanda, Insukamini and Munyati Solar projects have strong potential to be good investments in Zimbabwe. **Figure 1** shows Zimbabwe’s huge endowment of solar irradiance which the country can exploit to promote construction of huge solar farms as well as small scale rooftop solar projects in cities and villages [31]. However, according to the World Bank [28] the uptake of solar power projects in Zimbabwe is hampered and constrained by low and uncompetitive tariffs. These distorted market tariffs discourage investment in renewable energy projects. Competitive tariffs are market signals that attract investments. The tariffs need to be competitive enough to ensure returns on investment within prescribed timelines. This also allows investors to secure loans and capital from private sector sources. Zimbabwe’s current “subsidised” tariff is 9.86 USc per kWh. However, Samu, Fahrioglu [32] calculated the minimum Levelised

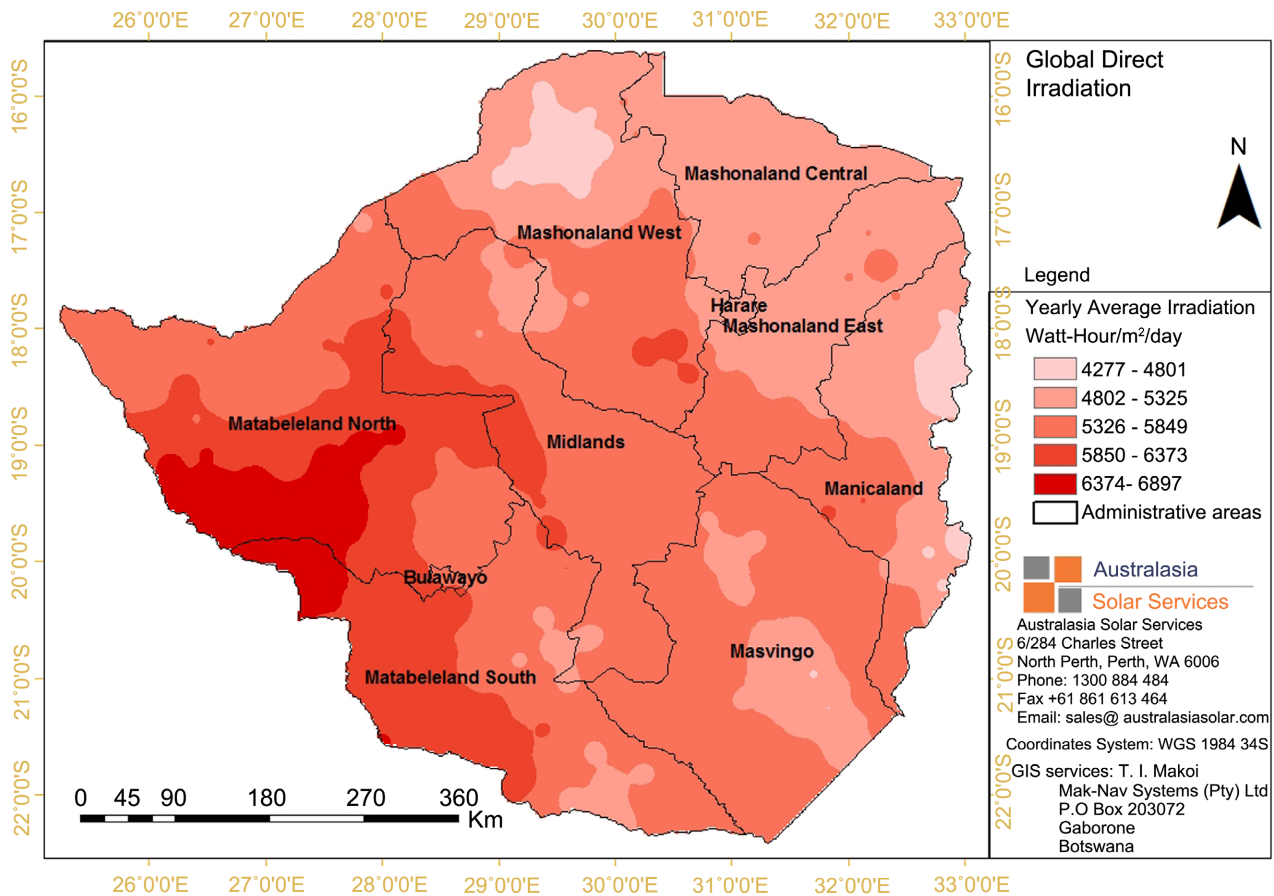


Figure 1. Indicative high horizontal irradiation map of Zimbabwe.

Cost of Energy (LCOE) in Zimbabwe to be 21 USc per kWh. Hence, to truly attract investments into its solar power sector, Zimbabwe will require negotiating and offering power purchase agreement tariffs that are above 21 USc per kWh.

With competitive price mechanisms in place, various BOT PPP arrangements can be negotiated to facilitate investment into this critical sector of the economy. Daily peak demand for electricity in Zimbabwe and Zambia stands at about 1600 MW, with deficits met by power imports from the region. A strategic plan of developing and harnessing the Zambezi basin's potential hydro power projects, and fully tapping of the solar power potential of Zimbabwe and Zambia can literally turn the countries' electric power deficit into a surplus and make them exporters of power.

1.3.3. Water and Sanitation Projects

Water and Sanitation plays a pivotal role in the economy of Zimbabwe and its inadequacy is a limiting factor in development of agricultural, industrial and mining activities as well as urban economic development. On the social end, water and safe running water provision is also a key defining factor in extreme poverty reduction. Zimbabwe's GDP growth is positively correlated to the country's seasonal rainfall pattern as agriculture feeds into manufacturing and financial services among others [33].

1) Gwayi-Shangani Dam and Pipeline

Bulawayo and Harare face perennial water shortages primarily as a result of rapid growth in population that has not been matched by investment in water and sanitation projects such as dam construction, water works, pipe upgrades and maintenance. The Gwayi-Shangani Dam is providing water supplies to city of Bulawayo with a population of 1.2 million people which experiences water scarcity due to decreasing dam capacity in drought seasons and during mid-year as a result of the arid conditions in Matabeleland. The \$600 million Gwayi-Shangani Dam and Pipeline falls under the Matabeleland Zambezi Water Project and is expected to provide uninterrupted water supply to more than 500,000 households, farms and businesses in the province once complete. The dam will facilitate industrialisation through stable water supplies and will help unlock various socio-economic activities through the supply of irrigation water for agriculture projects in Gwayi, Shangani, Lupane and Bulawayo Urban catchments. Irrigation schemes such as the Agricultural and Rural Development Authority (ARDA)'s Jotsholo Estate are being affected by low water supply from Shangani Dam and stable water supplies will ensure all year-round farming and increased hectareage of cereal and horticulture crops for exports.

The project has a strong IRR and economic impact and should have a straightforward PPP process as long as it is enabled through local and city governments who will be benefiting from the stable water supply.

2) Kunzvi-Musami Dam & Drinking Water Supply Project

The Kunzvi-Musami Dam & Drinking Water Supply Project (DWSP) is similar to Gwayi-Shangani except that it will enable a better future for the main city

of Harare and its satellite towns such as Chitungwiza and Ruwa. Ruwa, Norton and Chitungwiza with a population of around 5 million. Suburbs in the northern parts of Harare have no running water due to low pumping pressure and limited supplies. The whole area has been affected by shortage of water treatment chemicals, water loss and droughts and as a result, 50% of the residents in Harare, Chitungwiza, Norton and Ruwa rely on buying water or sinking boreholes for their sustenance while the poor have to be content with shallow wells. The \$865 million Kunzvi-Musami Dam & Drinking Water Supply Project (DWSP) will provide water for domestic and industrial use at competitive rates, cheaper than the cost incurred in recycling wastewater at Morton Jeffrey and Marlborough Water Works. The dam project will provide affordable bulk water for these residents while taking care of industrial demands for economic production purposes. Market gardening and horticulture projects in Norton, Ruwa, Domoshava and Goromonzi will also benefit from the dam.

The PPP for this project will similarly be able to fulfil multiple objectives for the Harare area as long as it is linked into local and city governance to ensure it is well governed in its delivery and long-term operations. It should be a BOT-PPP as this project will require a long contract that will span between 20 to 30 years of operations to allow the investors to fully recoup their investment costs and earn the expected rate of returns.

2. A Framework for Assessing Projects' Potential for PPPs

Two indicators are necessary for a project to be viable for a PPP arrangement, a good internal rate of return (IRR) and a significant economic impact on the society and economy. The first indicator will enable projects to be attractive to private investors and the second indicator will incentivise the government. According to Blanc-Brude, Whittaker [30] the required rate of return in infrastructure investments in emerging economies is very high:

“... investments in public infrastructure in emerging markets invites a higher equity premium compared to investments in OECD markets (between 6% and 7%), and investors demand a premium to invest in merchant infrastructure” [30].

A project that has a very high economic impact to the country, such as the Batoka Gorge Hydroelectric Scheme (BGHES) outlined above, will invoke the serious interest of any government. However, the risk of doing business in emerging economies, especially in Zimbabwe, is very high, hence, investors are only willing to invest in emerging markets if the IRR is on average around 16% or higher as compared to the average minimum requirement from the OECD markets of 10.6% [30].

According to Blanc-Brude, Whittaker [30] an IRR should be used as a tool to negotiate for private investment into the public infrastructure sector and can be also used as a standard means of presenting an investment proposition. Ideally, using Blanc-Brude, Whittaker [30] logic and calculations a government could

come up with a marketing strategy that will guarantee the rate of returns between 16% and 30% depending on the nature, urgency, and criticality of the project. This approach will entice the private sector to explore the investment in the public infrastructure projects. The government could run a tender bid using the IRR band of between 16% and 30% and attract the most efficient companies.

This study has selected some potential major projects in Zimbabwe and assessed them simply in terms of their documented IRR and economic impact (along with their extra benefits in terms of UN-SDG's-related economy-wide outcomes).

To attract private investments, public projects need to have attractive returns that will cover the risk of investment as elaborated by Blanc-Brude, Whittaker [30]. Private investors do have the option to invest their capital in low-risk investments; therefore, a project that will attract private investors should show that its returns are above the minimum returns required for low-risk investments. In this study we have identified the critical sectors of the economy that are necessary to get the Zimbabwean economy, especially the local authorities' economies, back on their feet. The three sectors of the economy commonly identified as critical by various international institutes such as the World Bank and other major developmental agencies are:

- The Energy and Power sector;
- The Road and Transport sector;
- The Water and Sanitation sector.

For this study's scope and demonstration, we opted to identify the top two major projects within each of these sectors that have the potential of higher returns to attract private investors and also have a very high positive economic impact to interest the government. Thus, projects identified above had the qualities below:

- Have a potential significant impact to the society and economy to be attractive to the government;
- Have a higher internal rate of return to attract private investors;
- Have undergone feasibility studies;
- Have a potential to be provincially owned (to allow local and central governments to be part of the partnership with the private partners).

Applying the above-identified qualities for project selection, we have identified and selected six projects from those three infrastructure sectors. These selected specific projects have a potential for significant macroeconomic impact to the country's economy.

Project Case Study Assessment Results

The projects case studies are all good in terms of their IRR and their potential broader economic impacts thus attracting private sector investment as well as ensuring broader common good objectives that government requires. Most of these projects could promote the much-needed sustainable development goals for Zimbabwe as well as creating the jobs and economic activity that can reverse

years of poverty. The high economic factor of the projects should incentivise the government to develop these potential projects, whereas the projects’ associated high IRR will attract the private sector and increase their willingness to invest in these public infrastructure projects. Also, there might be a need for regulations to be reviewed such as the tariff rates for power projects. Ideally, most of these projects could be delivered using the BOO and BOT structured PPPs. In accordance with the findings of Zheng, Lu [9], such potential PPP’s will require an ability to relate to the local socio-economic conditions at local and city governments levels. Therefore, the above projects are ideal for the government and private sector to work together and forge a win-win partnership.

3. Trackless Trams-PV (TTS-PV) Project in Bulawayo and Application of the PPP Model

The TTS-PV project has a strong IRR and economic impact credentials as set out in **Table 2** below.

3.1. TTS and the PPP Structure

The structure of the PPP that would work best for the TTS-PV would be a BOO model using three layers or levels of PPP arrangements as set out on **Figure 2** below.

The above PPP model for the TTS project for the city Bulawayo was developed in detail by Ndlovu and Newman [34]. The study constructed a PPP model referred to as a Three Multifaceted PPP Model (TMPM). The TMPM model is composed of three layers of players each required to structure a separate PPP arrangement. According to this model:

- Layer 1, the city council would lead the first layer responsible for road resurfacing (this would cost \$80 m roughly to resurface the 50 km of roads required in the city);
- Layer 2, the private sector developers would lead the second layer and will mainly be responsible for the construction of station precincts (costing around \$180 m for 30 stations and surrounding precincts);

Table 2. Bulawayo TTS-PV project IRR and economic impact assessment.

Project	Project Cost	Scope (size)	Economic Impact	Rate of return (IRR)
Bulawayo Trackless Trams-PV project	\$380 million under PPP (BOO) Models	<ul style="list-style-type: none"> • Resurfacing of 5 transit activated corridors (TACs)-wide roads (4 lanes each), with an expected cumulative length of approximately 50 km. \$80 m • Construction of 30 station precincts \$180 m • Purchase of 60 Trams of three carriages \$120 m 	<ul style="list-style-type: none"> • Improved transport system • Technological advanced and safe transportation system • Transit oriented development of the corridors • Employment opportunities • Economic stimulant for the city of Bulawayo 	>16%

Source: Newman, Davies-Slate [6].

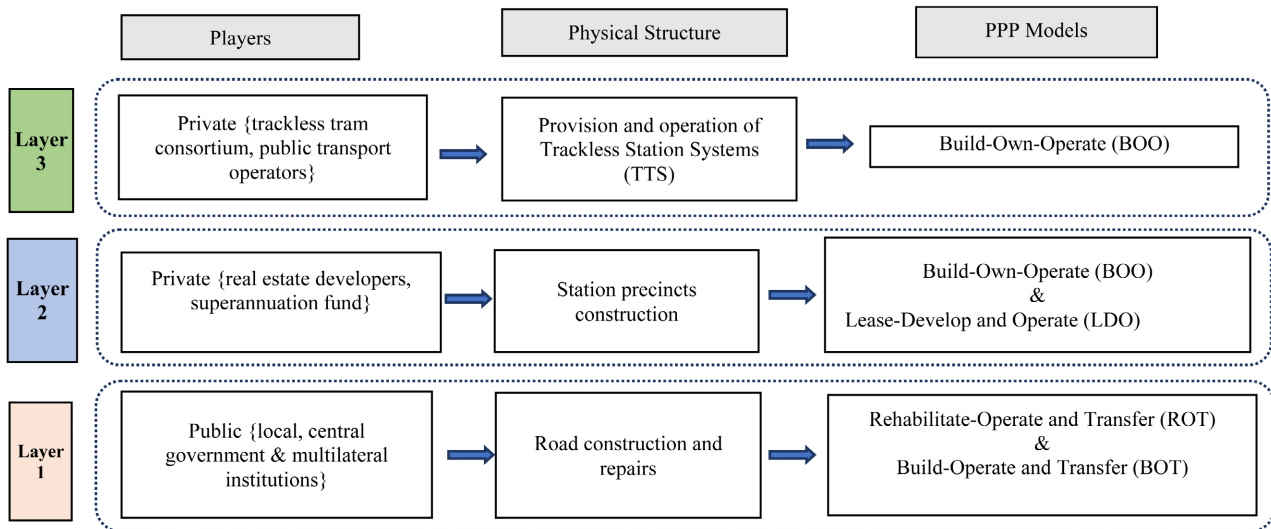


Figure 2. The Three Multifaceted PPP Model (TMPM) [34].

- Layer 3, the Trackless Tram consortium will purchase the Trackless Trams (costing \$120 m for the 60 three-car sets), operate the trams with shared public and private responsibilities.

The TTS project does indicate the potential to yield high positive economic impact for the city and the project has a very high IRR due to the opportunity to tap into urban development as the main source of commercial return rather than tolling as is done for private investment in road projects. This makes the TMPM model more pragmatic and more realistic to enable the delivery of the TTS project to the city of Bulawayo using a BOO type of PPP. More details of the TMPM are found in Ndlovu and Newman [34] study.

The TTS project has the potential to kick-start the economic activities of the City of Bulawayo. It will provide the capability for the City of Bulawayo to leap-frog technologically with regards to its public transportation network as well as assisting with establishing a roof-top solar power system within the city. Numerous public and private benefits can be derived from the adoption of trackless tram technologies as highlighted in previous studies [4] [27] [34].

3.2. TTS and Sustainable Development Agenda

Most of the projects identified above are more nationally oriented, however, the trackless tram-PV project is a localised project for the city of Bulawayo. This project has the potential to attract private investment to bring the major capital required to a significant transport problem in the city, through redeveloping a Transit Mall and providing opportunities for urban regeneration along several key corridors that can enable a return to the investors drawn into the project [4]. It can also solve many common good issues such as enabling the City of Bulawayo to transition towards transit-oriented development (TOD) through the selected transit-activated corridors (TACs) and to begin to utilise more roof-top solar in the city's future energy system as it moves towards more electromobility.

The roof-top solar system is now the cheapest of all power sources and can be made part of a national power grid with ability to not just provide power during the day but by introducing electromobility to a city with recharge options involving vehicle batteries (the TTS has batteries on its roof) then these can be used to provide grid balancing and other grid services [4].

Urban regeneration is likely to be attracted to the corridors where the trackless tram is built due to value uplift that can be used to attract the developers [6]. Ndlovu and Newman [4] have suggested the positive impact that TTS will have on the city of Bulawayo as:

“TTS will more likely regenerate the corridors from the CBD to the suburbs that are on the outskirts of the city’s CBD area. In addition, the introduction of the TTS will drastically reduce the cars and vans that clog the roads within the city centre”.

Thus, it is possible to see that there are multiple SDG outcomes from this project with potential to move to even more regenerative development opportunities [4].

4. Conclusion

The Trackless Tram-Solar project being assessed in this project has been found to fit a PPP structure of a Build Own Operate (BOO) system. This PPP has been suggested as being best delivered in three layers of differing levels of public and private investment and responsibility. These three levels are set up to ensure that there is strong government involvement where steps are needed that involve public infrastructure and needs while other levels involve strong private investment leadership where their strengths are needed. This model is based on a review of six large infrastructure projects in Zimbabwe in energy, water, and transport sectors. The assessment based on the review of the six case study projects showed that both a high internal rate of return (IRR) and a high economic impact on the broad economy and SDG’s, are necessary for implementing a successful PPP. A key insight was the need for local involvement in not only the local government but also in understanding the local socio-economic dynamics that are needed for the achievement of a PPP that can deliver benefit to both private investment outcomes and public common good outcomes.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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